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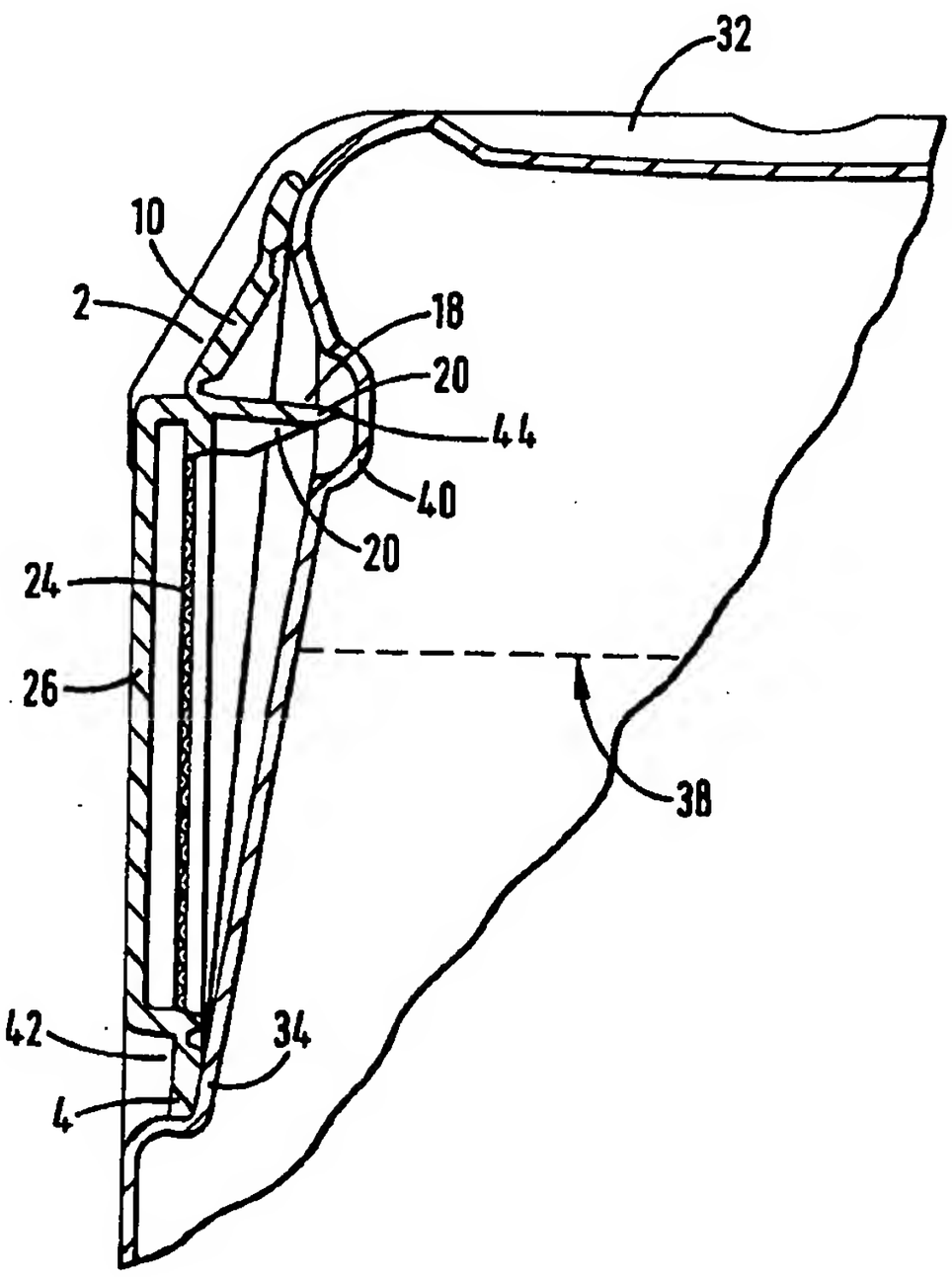
(54) Title: VENTING CONTAINERS

(57) Abstract

A container (32) and a vent unit (2) are described, wherein the vent unit includes a piercing element (18) movable relative to the container to form a vent opening therein. The preferred embodiment includes sealing means (4) and filter means (24) to provide a fluid path between the atmosphere and the container interior which passes through the filter to prevent ingress of contamination.



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VENTING CONTAINERS

The present invention relates to containers and venting devices therefor and in particular concerns containers for fluids which are susceptible to contamination by airborne contaminants.

In applications such as beverage dispensers, it is common to mix a flavoured concentrate with water at the point of sale or use. The concentrates, being food products, may spoil if they are exposed to certain contaminants in the air, for example, microbes or yeast particles. Accordingly to prevent such contamination the concentrate is usually supplied in a so-called "bag in box" container. Such containers comprise a sealed, flexible inner bag which contains the concentrate, the bag being arranged within a cardboard box or carton to protect the bag.

During dispensing of the bag's contents, no air enters the bag, so maintaining the contents clear of contaminants, and the bag collapses within the substantially rigid box or carton, due to external air pressure.

However it has been found that such bags do not tend to empty completely, and a proportion of the bag's contents

thus remains within the bag and is unused. In addition to the waste of their contents, "bag in box" containers are relatively expensive to produce.

The present invention therefore seeks to provide a container for fluids which has means to allow the container to drain completely, which will protect its contents from airborne contaminants, and which is relatively simple and inexpensive to manufacture.

From a first aspect therefore, the present invention provides a container comprising vent means, said vent means comprising opening means for producing a vent opening in a wall of the container and filter means for preventing contamination of the contents of the container through the vent opening.

Thus in accordance with the invention, a container is provided with vent means which allow air to enter the container as its contents are dispensed, thereby preventing the pressure in the container falling below the external pressure and thus promoting easy and complete dispensing of the fluid in the container. Thus a container of the present invention may have minimal wastage of its contents.

Moreover filter means are associated with the vent means

so as to filter airborne contaminants from the air entering the container. Thus the contents of the container will remain untainted.

The container of the present invention has the advantage over the prior art that it allows a standard non-collapsing container (for example a carton or a plastic bottle) in which an outlet is provided to be used for dispensing fluids, while at the same time keeping the contents untainted. Thus a single container, rather than a 'double' container arrangement may be used.

The vent means could be provided on the container in a number of ways. For example they could be formed integrally with the container. However, in a preferred embodiment, the vent means comprises a unit which is mounted in or to an external wall of the container, for operation by a user.

From a second aspect the invention provides a vent unit for a container, said vent unit comprising opening means for producing a vent opening in a wall of a container and filter means for preventing contamination of the contents of the container through the vent opening.

A separate vent unit has the advantage that it can be manufactured separately from the container body and then

mounted to the container at a convenient time, for example by the container manufacturer, by the filler when the container is being filled or by a user when he wishes to dispense from the container.

The vent opening means may comprise any means suitable for creating an opening in the container wall. For example, a push tab or tearing mechanism could be provided in the container wall. However in the preferred embodiment of the invention, the opening means comprises a piercing means which can be depressed by a user to pierce an opening in the wall of the container.

The piercing means could be withdrawn from the container body after piercing so as to allow air to enter the container through the hole left by the piercing means. However in the preferred embodiments, the piercing means itself provides an airflow passage. This allows air to enter the container without the piercing means being removed from the container wall which may simplify the construction and operating of the vent opening means.

The airflow passage in the piercing means could be formed in a number of ways. For example the piercing means could consist of a hollow tube with a sharp edge at the piercing end thereof. In the preferred embodiment however, the piercing means comprises a piercing point

behind which are provided a plurality of spaced, outwardly tapered ribs. As the piercing point breaks through the container wall and enters the container, the outwardly tapering ribs engage the opening formed and expand it further, the space(s) between the ribs defining the airflow passage(s). This arrangement has the advantage that it is less likely to block the airflow passages by e.g. a flap of material that could be removed by other opening forming means.

It will be apparent that the filter means is preferably arranged such that once the vent opening has been formed, all flow therethrough will pass through the filter. Thus in one simple embodiment, the vent unit may comprises a tubular piercing means with a filter over the external end thereof. However, it is quite likely that a perfect seal will not be achieved between the piercing means and the container wall. Preferably therefore the piercing means defines a chamber around the vent opening, with the filter means being arranged at an air inlet opening provided in the diaphragm. The chamber may advantageously be defined at least in part by a flexible diaphragm sealably fixable at its edge to the exterior surface of the container wall.

In an alternative embodiment, the chamber may be defined in part by a flexible diaphragm, and in part by a

substantially rigid housing part. The piercing means in such an embodiment is mounted to the flexible diaphragm for movement towards the container wall to effect piercing. The substantially rigid housing part may accommodate the filter means and provide a vent path to atmosphere.

The chamber defined between the container and diaphragm may be sterilised after attachment of the vent unit to the container to remove contaminants which may have been trapped there during manufacture. Thus contaminants will not be able to enter the container around the pierced portion of the container wall as could otherwise be the case.

The flexible diaphragm of the preferred embodiment is bistable, and is generally dished to prevent a concave face to the container initially. The flexibility of the diaphragm permits it to invert when pressure is exerted from outside, to assume a configuration presenting a convex face to the container. This allows the piercing means provided on the diaphragm to be held stably by the diaphragm in a first position away from the container wall, and after piercing in a second position penetrating the container wall. This arrangement has the advantage that the airflow passage provided by the piercing means will not be disrupted by movement of the piercing means.

The filter in the vent means could be provided in many different ways. For example as discussed above the filter could be provided in one end of a tubular piercing means. In the preferred embodiment of the invention however the filter is provided in a portion of the diaphragm. In an alternative embodiment, the filter may be fixed across an opening in a substantially rigid housing part of the vent unit.

In order to protect the filter against possible damage, in particular when the piercing means is depressed by a user, a cover is preferably provided over the filter. Preferably the cover is spaced away from the filter so as to define air flow openings therebeteen. This has the advantage of providing a relatively large air flow area and thus allowing a high rate of airflow into the container. This will promote smooth dispensing of liquid out of the container, and prevent unfiltered air from being sucked or 'gulped' into the container through the dispensing opening.

It will be appreciated that the vent unit of the invention could be mounted to a container in a number of ways. However, in a preferred embodiment the container of the invention is provided with a recess in which to mount the vent unit. The mounted unit will thus not project outwardly from the container wall meaning that

the containers can be more closely stacked together, and also reducing the likelihood of damage to the vent unit during handling.

The vent means of the invention may be used with any container having a frangible wall portion. Preferably the container is of a plastics material, more preferably a blow moulded container. The container may have a thinner wall portion aligned with the piercing means so that the container wall may be pierced more easily by the user on depressing the piercing means.

The vent unit is preferably of moulded plastics material. The vent unit may be attached to the container in any suitable manner, for example by heat sealing, adhesive bonding, ultrasonic welding, or snap engagement. Most preferably the filter is insert moulded in the vent unit at its time of manufacturer. The filter should have a sufficiently small mesh or pore size to catch air borne contaminants. For example it may be a microsporous membrane e.g. of nylon, ptfe, acrylic copolymer, polysulfone or cellulose acetate. Such filter materials are widely available commercially.

The vent unit is preferably mounted at one end of the container in such a position that the vent unit will pierce the container above the fluid level in the

container when the container is oriented for dispensing. This will prevent the filter means coming into container with the container contents, and thus becoming blocked or contaminated, or allowing fluid to leak out of the container. In addition as microsporous filters may be damaged by contact with certain fluids it is preferably that the filter does not come into contact with the fluid in the container at any stage. Typically therefore, a container may be provided with a flow outlet at one end, and the vent unit at the other.

In the above described embodiments of the invention, the vent means includes a filter to prevent contamination of the contents of the container. However, a vent unit substantially as described above but without any filter means is also believed to be novel and inventive in its own right. Thus from a still further aspect the invention provides a vent unit for a container, said vent unit comprising means for mounting said vent unit to an external wall of said container; and piercing means for producing a vent opening in a wall of said container, wherein said piercing means at least partially defines an air passage is movable relative to the container wall. The piercing means is preferably provided on a flexible support.

Such a vent unit has the advantage that it is simple to

produce, may be permanently mounted to a container wall and is easy to use. In addition such a unit may be used with any container, as the piercing means at least partially define an air passage, it need not be removed after piercing the container wall, thus avoiding the extra effort required by the user to do this.

Embodiments of the invention will now be described, by way of example only, and with reference to the accompanying drawings in which:

Figure 1 is a rear plan view of a first vent unit of the invention;

Figure 2 is a front plan view of the vent unit of Figure 1;

Figure 3 is a section taken along line AA of Figure 2;

Figure 4 is a second taken along line BB of Figure 2;

Figure 5 is a side elevation of a container with a recess therein;

Figure 6 is a side elevation of the container of Figure 5, the vent unit of Figures 1 to 4 being mounted in the recess on the container;

Figure 7 is a section through a portion of the container prior to the container wall being pierced;

Figure 8 is a section through a portion of the container after the container wall has been pierced;

Figure 9 is a sectional view of a second vent unit of the present invention; and

Figure 10 is an underneath plan view of the vent unit of Figure 9.

As shown in Figures 1 and 2, a plastics moulded vent unit 2 is provided. The vent unit 2 is of substantially trapezoidal form and has an outer peripheral flange 4 extending about a flexible diaphragm 6. The diaphragm 6 is provided with sloping walls 8, 10, 12 which project forwardly of the flange 4 (see Figures 2 to 4). A rectangular venting aperture 14 is formed in the diaphragm 6 and has a rim 16 formed around its edge.

A piercing means 18 is provided on the rim 16 at the edge of wall 10. The piercing means 18 which has a triangular body 20 and three tapering ribs 22 formed thereon extends away from the rim 16 back towards the flange 4. A microporous filter 24 extends across the full area of the aperture 14 and is insert moulded to the rim 16. A cover

26 is provided in front of and substantially parallel to the filter 24, and is offset from the aperture 14 so that air opening 28, 30 (see Figure 4) are formed between the cover 26 and the filter 24.

In use, the vent unit 2 as described above is mounted to a moulded plastics bottle 32 for example by heat sealing or adhesives, the outer flange 4 being received against a complementary surface 34 of the bottle 32. As shown in Figure 5, the bottle 32 has a recess 36 formed therein for receiving the vent unit 2 and a flow outlet 37 formed at the opposite end of the bottle 32. As shown in Figure 6, the recess 36 is positioned on the bottle 32 such that, in use the piercing means 18 of the vent unit 2 will lie above the level 38 of fluid in the bottle 32. Thus the bottle 32 will remain sealed in the upright position during filling and storage, the unpierced bottle wall 40 separating the fluid in the bottle from the filter 24 of the vent unit 2. Prior to use, the bottle 32 is inverted so that the opening in the bottle wall 40 formed by the piercing means 18 will lie above the level 38 of fluid in the bottle. The bottle will then remain in the inverted position until it is empty so as to avoid fluid leaking from the filter. In addition to the above the recess 36 is so formed that the vent unit 2 does not project outside of the profile of the bottle 32 (see Figures 7 and 8) either before or after the bottle 32 is

pierced.

As shown in Figures 7 and 8, when the cover 26 and piercing means 19 of the vent unit 2 are depressed by a user so as to pierce the bottle wall 40, the cover 26, filter 24 and piercing means 18 pivot together (clockwise as seen in Figures 7 and 8) about the lower end 42 of the vent unit 2 and the flexible diaphragm 6 defers so that walls 8, 10 and 12 invert to project on that side of flange 4 nearer to the interior of the container. Firstly the point 44 of the piercing means 18 breaks through the wall 40 of the bottle 32, and then the tapering ribs 22 push back the edges of the opening formed by the point 44 until the diaphragm 6 has reached a position in which walls 8, 10, 12 project inwardly of the bottle 32 from flange 4 and the piercing operation is complete. The piercing means 18, filter 24 and cover 26 are then held stably in position by the flexible diaphragm 6 as the wall 10 pushes them in towards the bottle 32 and thus locks the piercing means 18 in position. It can thus be seen that the flexible diaphragm 6 of the above described structure is bistable.

Once the piercing operation has been completed, air may flow through the air openings 28, 30 and through the venting aperture 14 and filter 24 before entering the bottle 32 through the air flow passage provided in the

piecing means 18. Likewise, over pressure within the bottle can be equalised by air flowing out via the same path.

Figures 9 and 10 are sectional and plan views, respectively, of a second vent unit according to the invention. The vent unit comprises a generally conical diaphragm 56, from a truncated apex 57 of which a piercing shank 58 of cruciform section extends axially. The shank 58 comprises four ribs 52 and a piercing tip 54.

A generally rectangular housing 60 extends radially of the diaphragm 56, and the housing 60 and diaphragm 56 are surrounded by a fixing flange 64 and a sidewall 65.

The housing 60 is substantially rigid, and contains a filter element 66 which may partially (as illustrated) or completely fill the housing 60. Vent openings 67 allow air to enter the housing 60 through the filter 66. The diaphragm 56 is flexible, and may be so dimensioned as to be invertible to a stable position in which the piercing shank 58 and tip 54 project beyond the plane of the fixing flange 64. Alternatively, the piercing shank may be barbed (not shown) to resist withdrawal from an opening in a container wall pierced by the shank.

The fixing flange 64 may be attached to the container as before by welding or bonding. It is foreseen, however, that the vent units may be sold separately from their containers, and may be used with conventional containers having no special adaptation. In such situations, the fixing flange 64 may be provided with a self-adhesive layer covered by a release liner which is removable to adhere the vent unit to a container. Preferably, the release liner will extend across the entire sealing flange to form a chamber with the diaphragm 56 and housing 60. In this way, the interior of the vent unit is protected against contamination prior to use. When used, the vent unit is fixed to a container wall by means of the fixing flange 64, to form a chamber defined by the container wall and the diaphragm 56 and the housing 60 and vented to atmosphere via the filter element 66 and venting openings 67.

Pressure on the truncated apex 57 of the conical diaphragm 56 causes the walls of the diaphragm to flex and the piercing tip 54 of the shank 58 pierces the container wall and enters the container.

The piercing shank may be provided with one or more barbs (not shown) to engage the inner surface of the container wall and retain the shank 58 in its position penetrating the wall. Alternatively the conical diaphragm 56 may be

so configured as to adopt an inverted conical position to maintain the shank 58 in its penetrating position.

The cruciform section of the shank 58 ensures that air passageways are open to provide fluid communication between the container interior and the vent chamber.

In either of the embodiments described, the filter element may be omitted if it is not necessary to protect the commodity to be dispensed against airborne contaminants. Containers for recharging dispensers for hand cleaning agents or industrial lubricants, for example, may be able to omit the filter element from their vent units.

In an alternative embodiment, not illustrated, the piercing element may be formed as a separate component from the diaphragm and housing, and may be pivotally, slidably, or otherwise movably mounted to the housing so as to be operable, by deforming the diaphragm, to pierce the container wall. Such a construction may find utility when a piercing element of greater strength than is achievable with plastics material is required. The piercing element may be made of metal, so as to be able to pierce metal containers such as oil cans.

Persons skilled in the art will appreciate that the

embodiments described above are only two possible embodiments of the invention as claimed. For example a container of any form could be used together with a vent unit of the present invention. In addition, the piercing and vent means of the vent unit could take different forms from those described above. For example, the piercing means could be formed of a hollow tube with a sharp edge at one end thereof, a filter being provided within the tube and air flowing through the tube into the container after the container wall is pierced by the tube.

Claims:

1. A container having a discharge opening and vent means operable to provide a vent opening in the container, the vent means comprising a piercing element mounted to the container for movement between a first position in which the piercing element is outside the container and a second position wherein the piercing element penetrates a wall of the container to form a vent opening therein.

2. A container according to claim 1, wherein the vent means comprises deformable wall means mounted to the container and supporting the piercing element.

3. A container according to claim 2, wherein the deformable wall means and the container define a chamber, and fluid communication between the outside and the chamber is provided.

4. A container according to claim 3, wherein the fluid communication path between the chamber and the outside passes through a filter element.

5. A container according to claim 5, wherein the filter element is mounted across an opening in the deformable wall means.

6. A container according to any of claims 3 to 5 wherein the deformable wall means is a diaphragm.

7. A container according to any of claims 2 to 6, wherein the deformable wall means has two stable configurations.

8. A container according to any preceding claim wherein the container wall is formed with a recess to receive the vent means.

9. A container according to any preceding claim wherein the container wall is weakened so as to facilitate penetration by the piercing element.

10. A container according to claim 1, wherein the piercing element is pivotally mounted to the container.

11. A container as claimed in any preceding claim wherein the vent unit is mounted at one end of the container so that the vent unit will pierce the container above the fluid level in the container when the container is oriented so as to allow fluid to exit via the flow outlet.

12. A vent unit mountable to a container, comprising:

mounting means to attach the vent unit to the

container; and

piercing means movable relative to the mounting means between a first position and a second position for producing a vent opening in the container.

13. A vent unit according to claim 12, comprising a mounting flange for attachment to a container;

a deformable wall portion attached to the mounting flange;

and wherein the piercing means is a piercing shank supported by the deformable wall portion.

14. A vent unit according to claim 13, wherein the deformable wall means at least partially defines a chamber having an open side bounded by the mounting flange and a venting opening.

15. A vent unit according to claim 14, wherein the venting opening is covered by a filter element.

16. A vent unit according to any of claims 12 to 15 wherein the piercing means at least partially defines an air passage.

FIG. 1

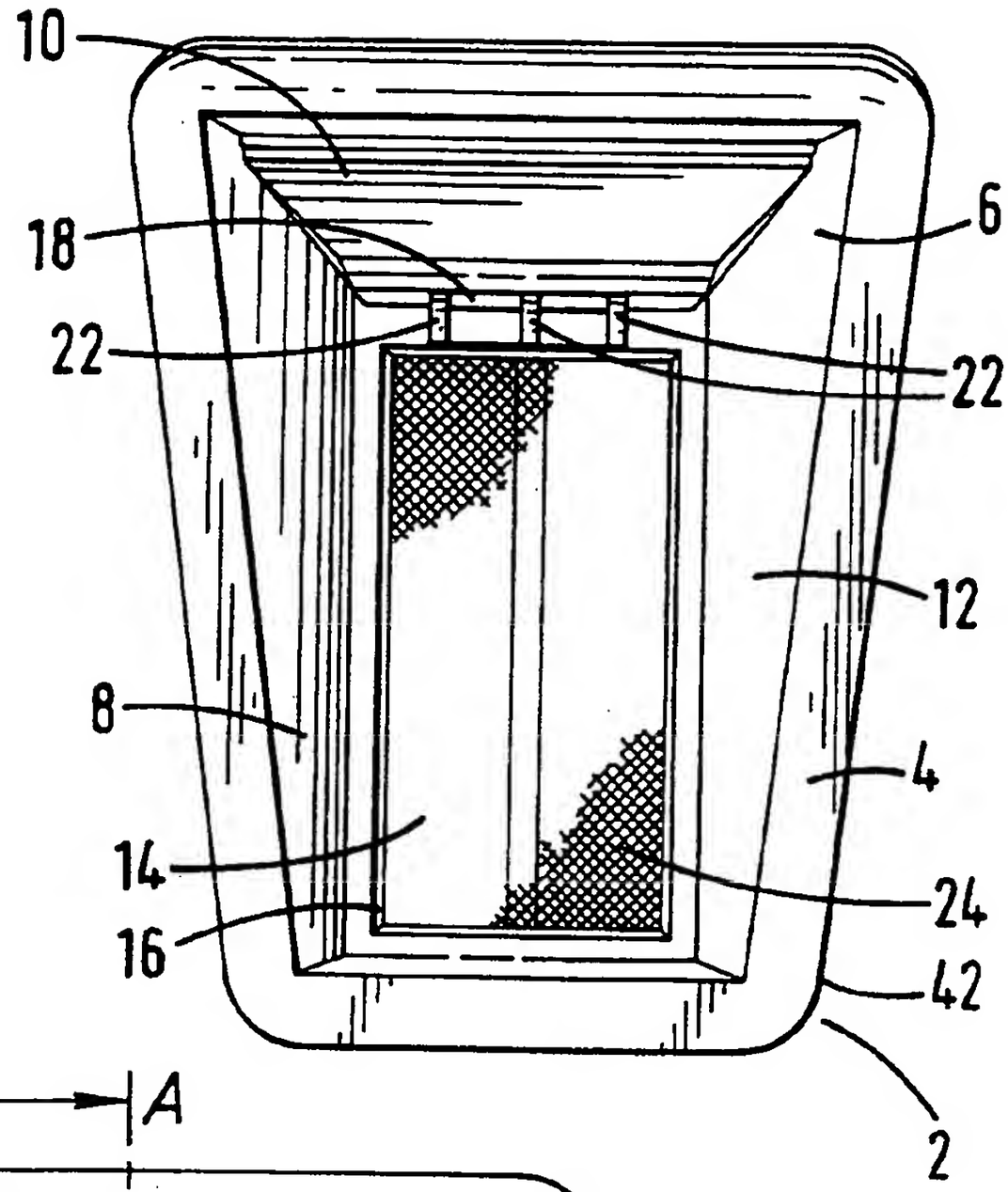


FIG. 2

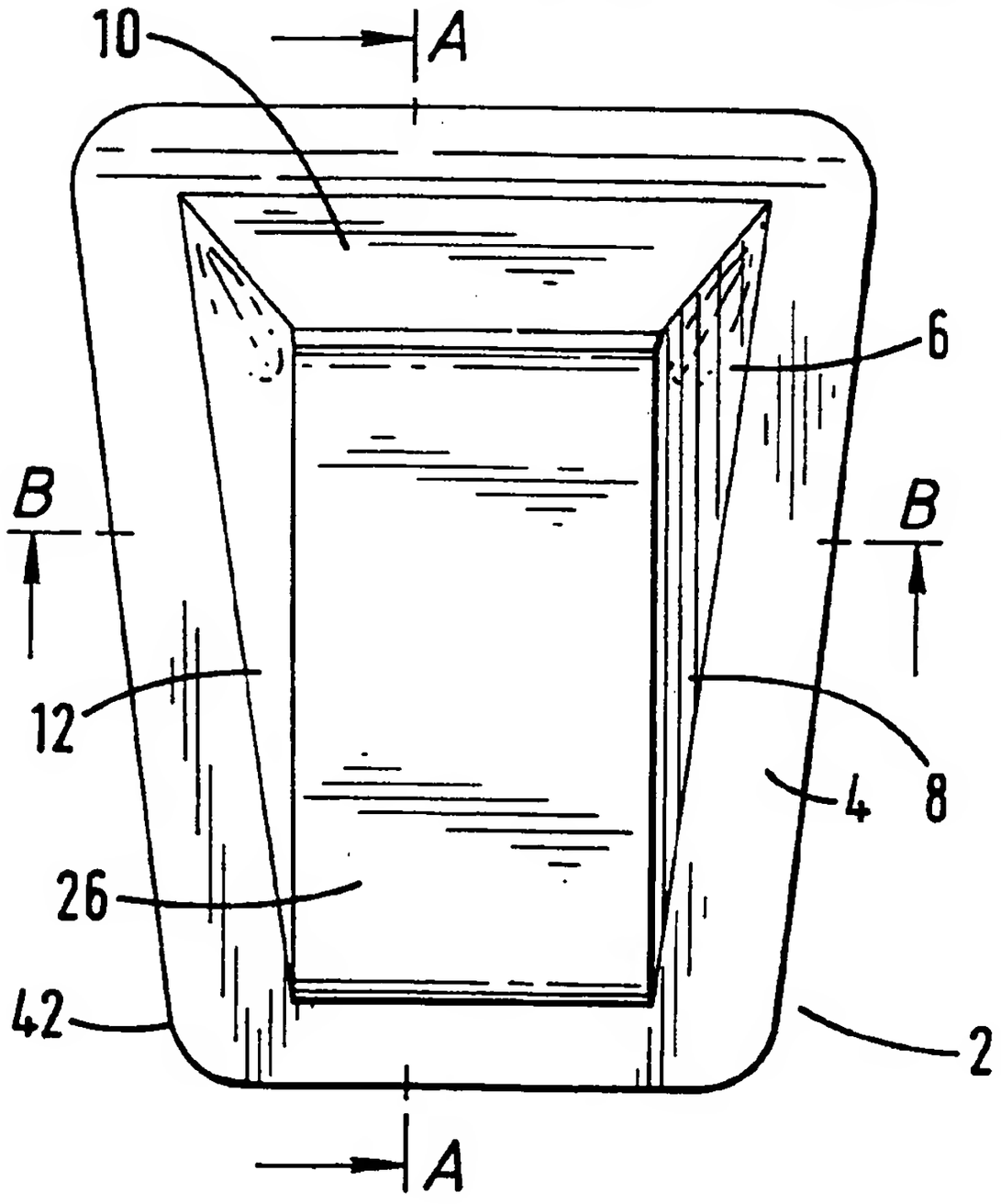


FIG. 3

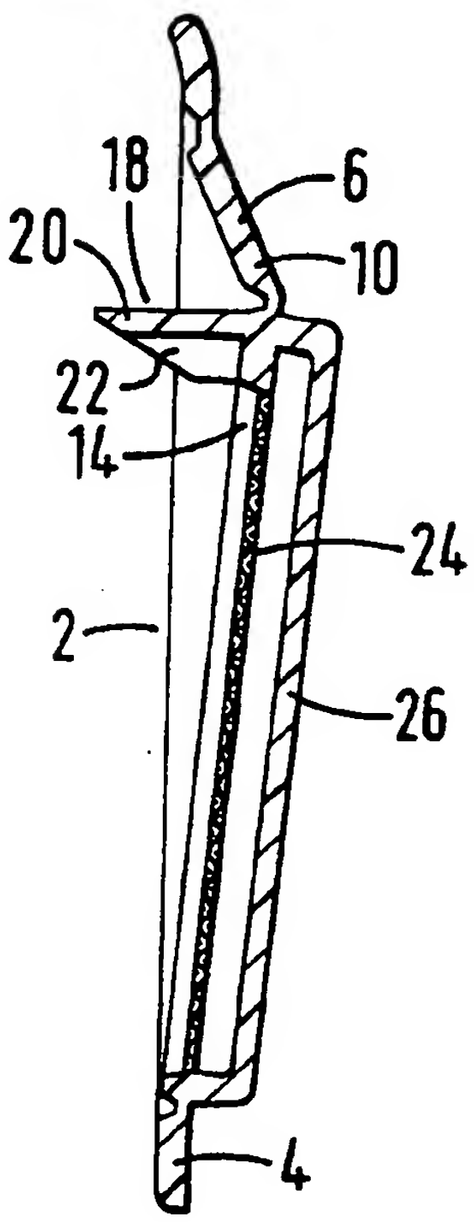


FIG. 4

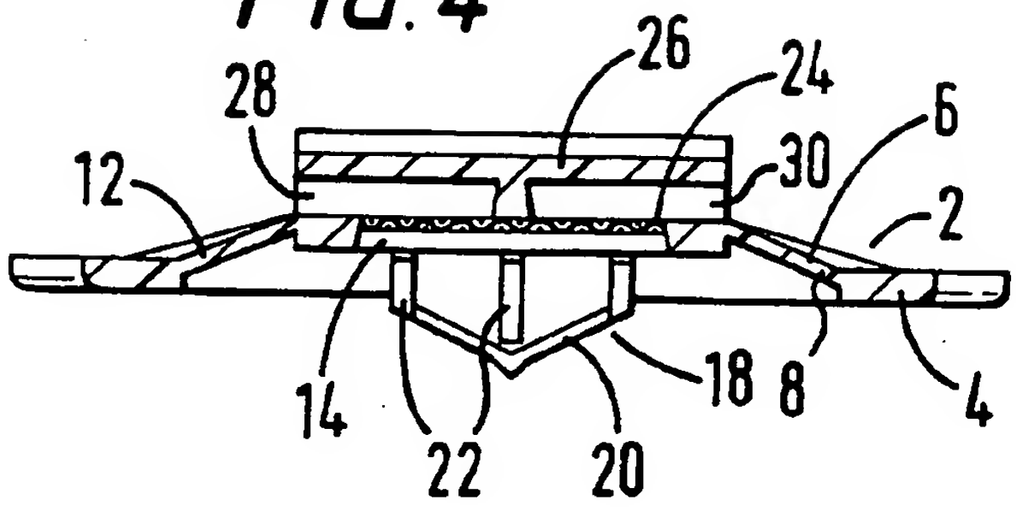
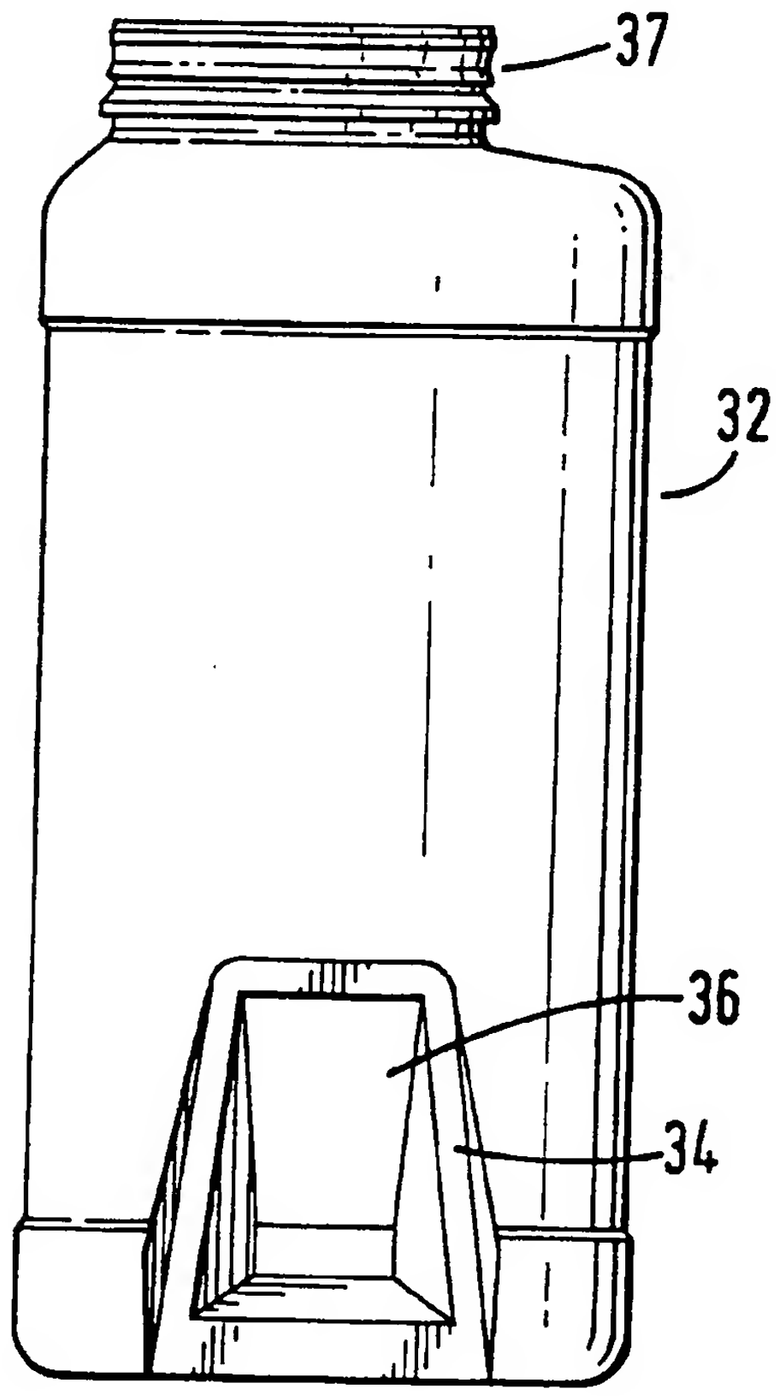


FIG. 5



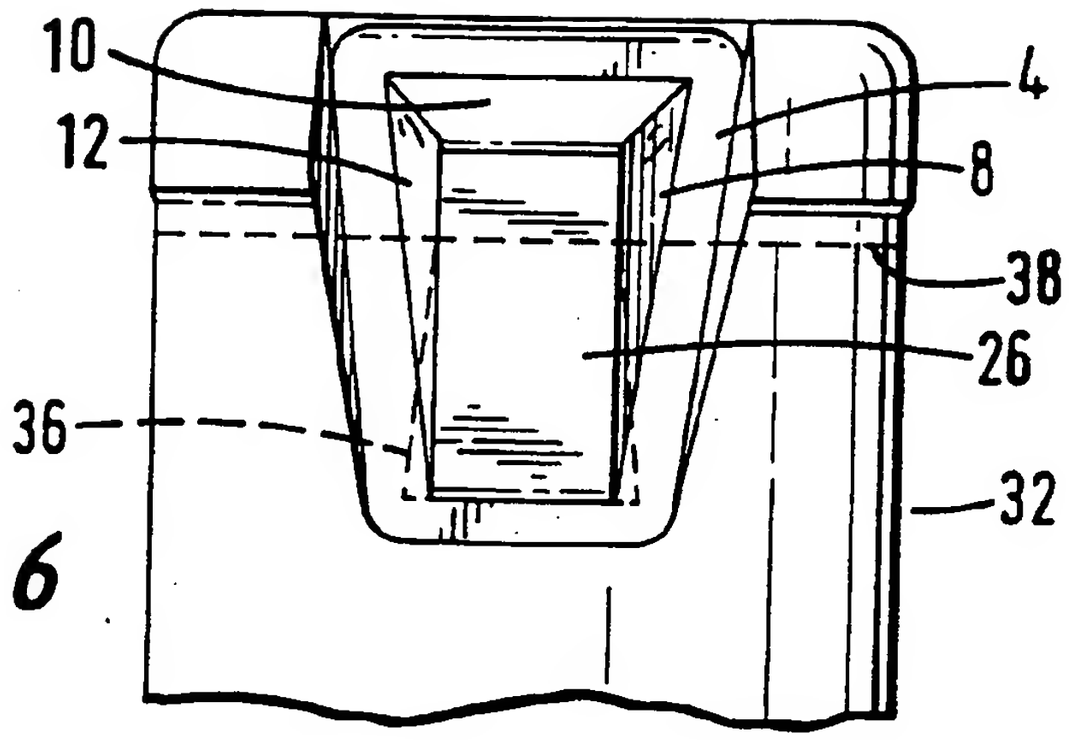


FIG. 6

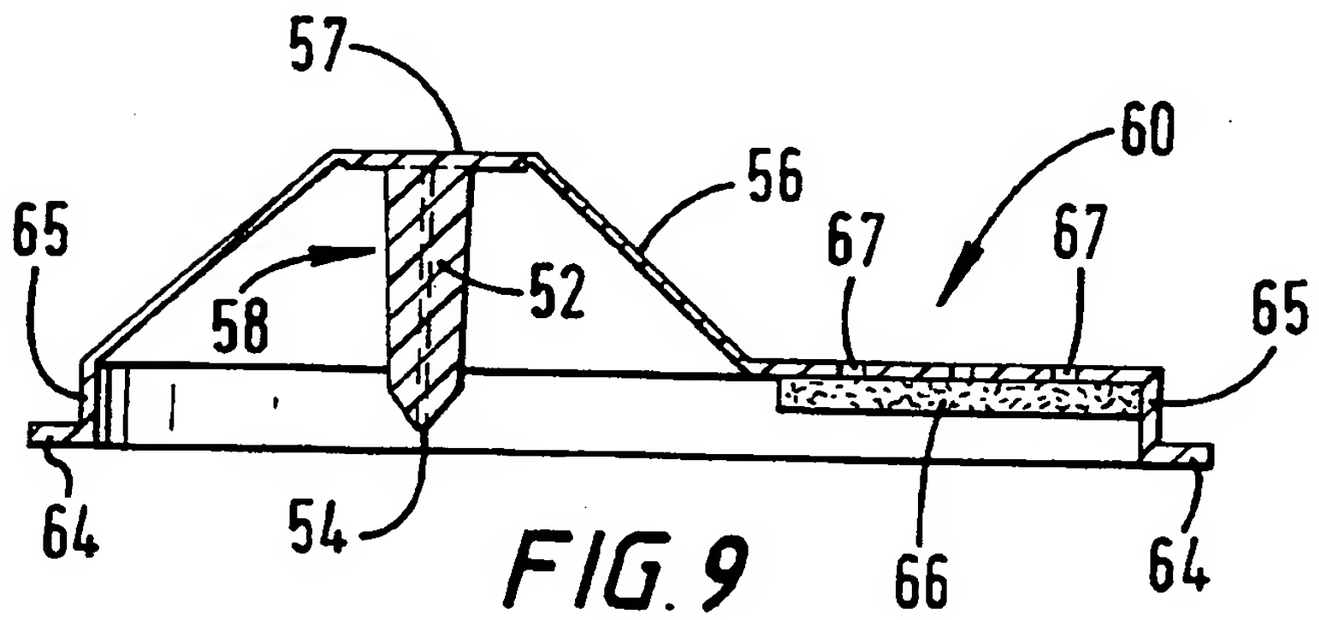


FIG. 9

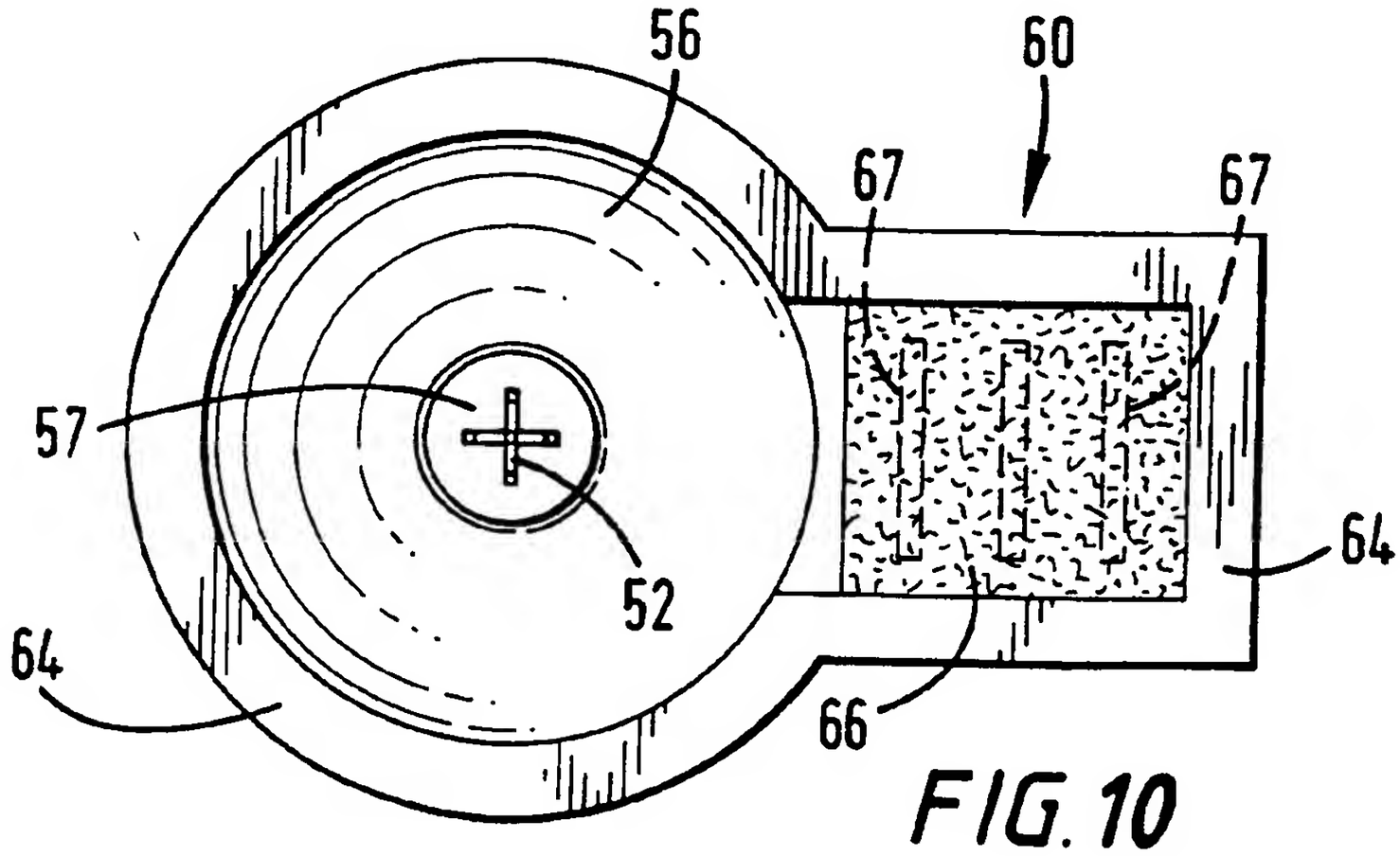


FIG. 10

FIG.7

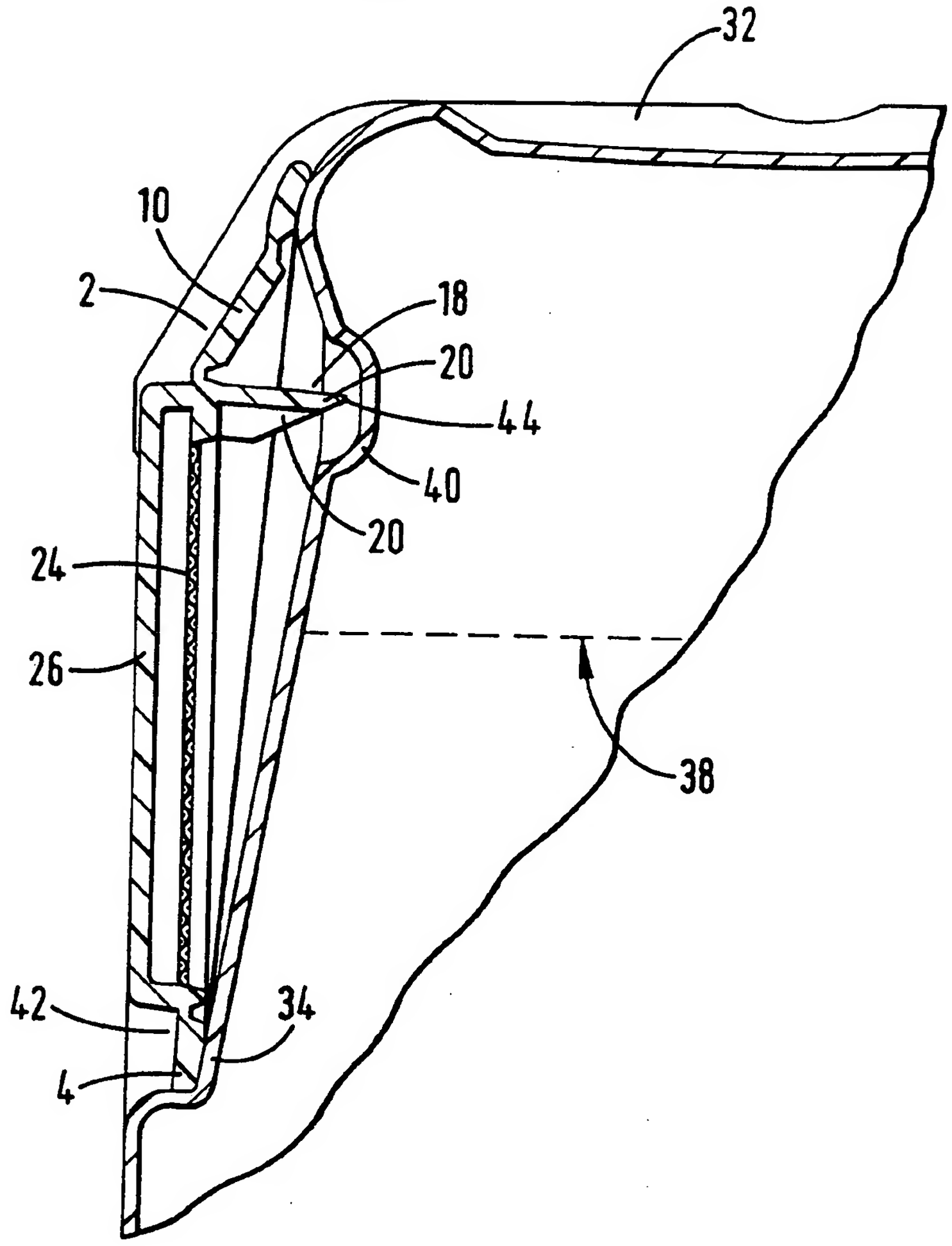
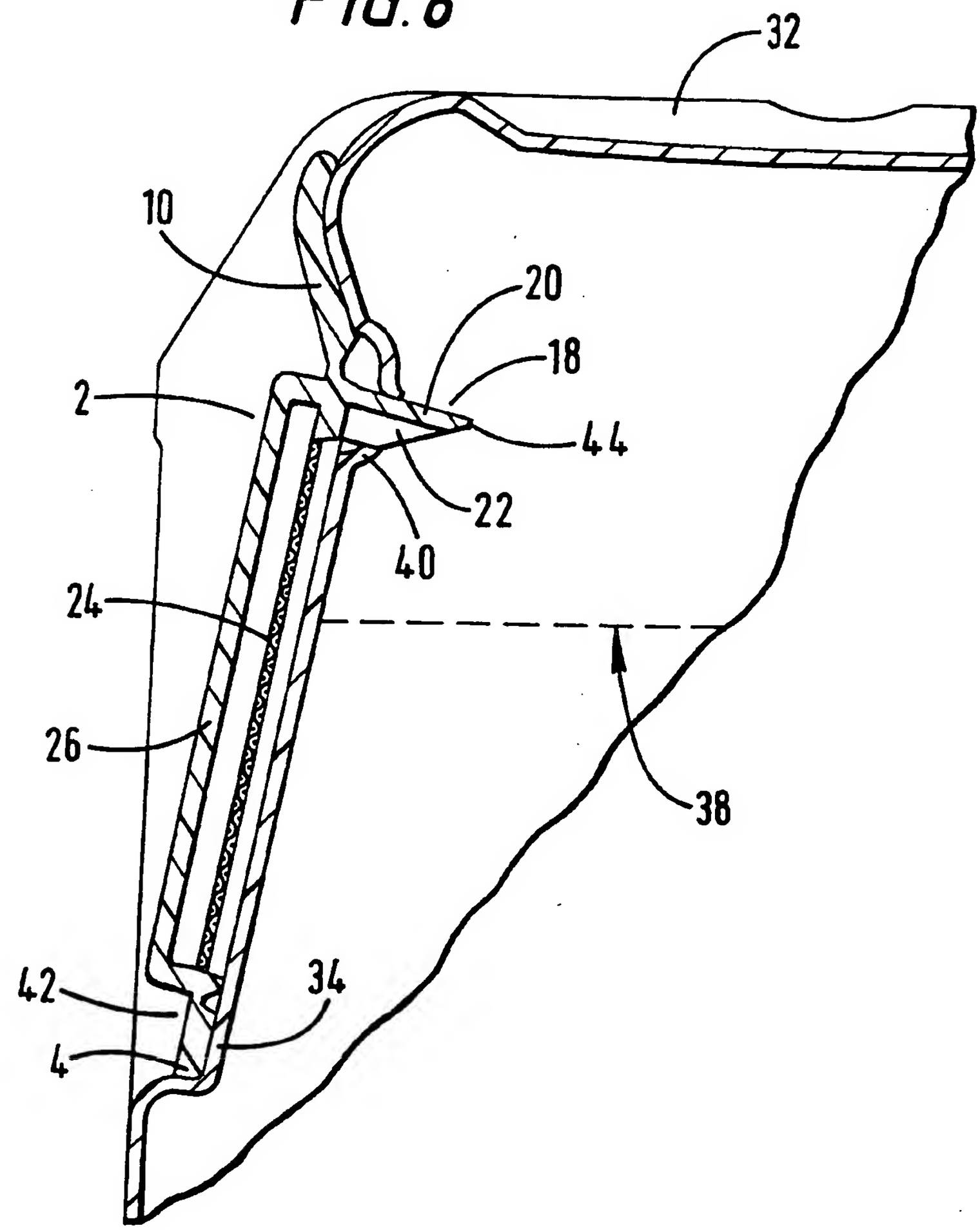


FIG. 8



INTERNATIONAL SEARCH REPORT

Inter nal Application No
PCT/GB 98/03492

A. CLASSIFICATION OF SUBJECT MATTER
IPC 6 B65D77/22 B65D23/00

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
IPC 6 B65D B67D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X Y	US 5 472 112 A (MACIEJEWSKI) 5 December 1995 see claim 1; figures 2,6	1-3,8,9, 11-14 4,6,7, 15,16
Y	EP 0 729 901 A (PROCTER & GAMBLE) 4 September 1996 see claim 14	4,15
Y	GB 1 059 574 A (FLEXILE METAL COMPANY) 22 February 1967 see page 4, line 10 - line 23; figure 1	6,7
Y	EP 0 411 384 A (ABBOTT LABORATORIES) 6 February 1991 see figure 9	16

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[X] Further documents are listed in the continuation of box C.

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Date of the actual completion of the international search	Date of mailing of the international search report
18 March 1999	25/03/1999

Name and mailing address of the ISA	Authorized officer
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